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DEPARTMENT OF HEALTH

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December 2, 2014

Mayor Ralph Falloon
Village of Cold Spring
85 Main Street
Cold Spring, NY 10516



Re: Approval of Plans for a Pump Station Replacement
at Market Street
(V) Cold Spring

Dear Mr. Falloon:

This office has received the engineering plans and specifications for the wastewater pump station replacement for the above-noted project. Upon review, it has been determined that the submission meets the applicable criteria of the NYS Department of Environmental Conservation and the Putnam County Health Department.

The approval of plans is issued under provisions of Article 17 of the Environmental Conservation Law and 6 NYCRR 652, and is issued for plans consisting of 3 B/W sheets prepared by Oakwood Environmental Associates, and dated May 16, 2012 with the last revision date of November 18, 2014.

The project is located in the Village of Cold Spring. This letter of approval of plans and a set of the approved plans should be filed in the appropriate office of the Village of Cold Spring.

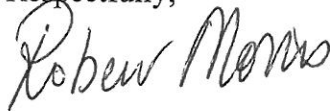
This letter shall serve as record of approval and by initiating construction of the project covered by this approval of plans, the applicant accepts and agrees to abide by and conform to the following:

1. THAT the approval letter shall be maintained on file by the applicant.
2. THAT the approval is revocable or subject to modification or change pursuant to Article 8 of the Putnam County Sanitary Code and Article 17 of the Environmental Conservation Law.
3. THAT the facilities shall be fully constructed and completed in compliance with the engineering report, plans, and specifications as approved. The Putnam County Health Department must be notified when construction commences on the sewer collection system and provided with a construction schedule.

4. THAT the construction of the facilities shall be under the supervision of a person or firm qualified to practice professional engineering in the State of New York under the Education Law of the State of New York, which supervision is the responsibility of the applicant.
5. THAT the design professional supervising such construction shall certify to the Department in writing, that the construction of the facilities has been under their supervision and that the work has been fully completed in accordance with the approved engineering report, plans, specifications and approval of plans.
6. THAT the certification, including acceptable results of leakage testing of the completed works, and "as-built" plans shall be forwarded to the Putnam County Department of Health after completion of construction and at least within thirty (30) days thereof.
7. THAT the facilities shall not be placed in operation until construction has been completed and the Department has accepted, in writing, the certification of construction and results of leakage testing.
8. THAT the approval is valid for five (5) years and expires on December 2, 2019.
9. THAT the construction conforms with applicable ordinances of the Village of Cold Spring.
10. THAT the facilities shall be constructed and completed in compliance with the engineering report, plans, and specifications as approved by this Department. Any modifications to the approved plans and specifications shall require prior approval by this Department.

This approval of plans is issued for replacement of the Market Street Pump Station to include duplex submersible pump station, new pump station control panel and electrical enclosures and appurtenances, and is issued for the State Commissioner of Environmental Conservation.

Respectfully,



Robert Morris, P.E.
Director of Environmental Health

RM:cml

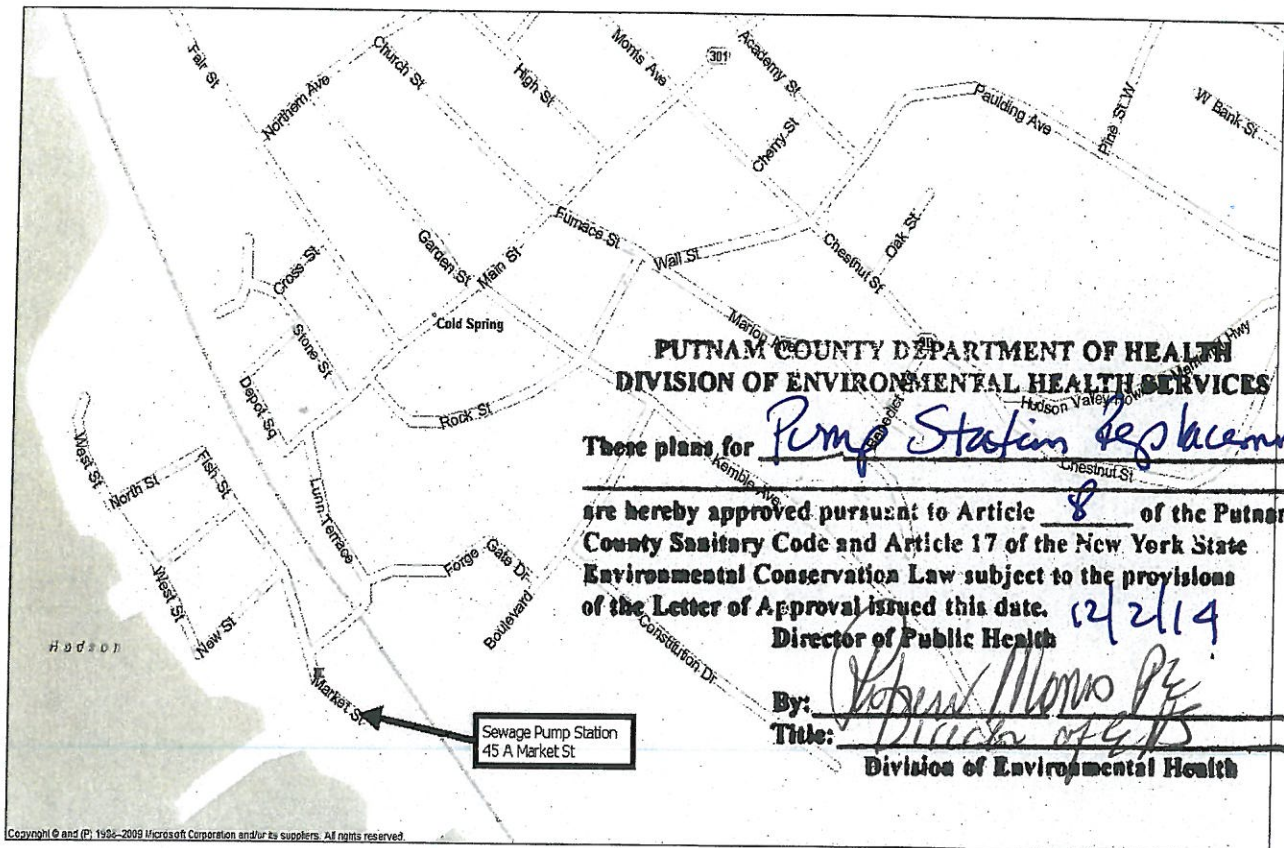
cc: Bart Clark, P.E., Design Professional
Michael J. Budzinski, P.E.
NYSDEC, White Plains

Technical Specifications

for

Sewage Pump Station Replacement

45A Market Street, Cold Spring, Putnam County, NY



Prepared for

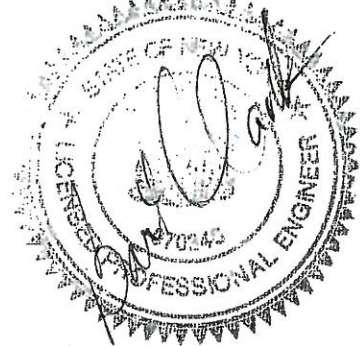
The Village of Cold Spring

Putnam County, NY

Prepared by

Oakwood Environmental Associates

November 18, 2014



Warning: It is a violation of Section 7209 of the New York State Education Law for any person to alter in any way plans, specifications or reports to which the seal of a Professional Engineer has been applied; unless acting under the direction of a licensed Professional Engineer and that Engineer applies their seal to the altered plan, specification or report.

Technical Specifications

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Section 01 10 00 Summary of Work

PART 1 - General

1.01 Summary

The Village of Cold Spring is replacing the Sewage Pump Station on Market St due to its poor condition and to improve issues associated with access of the pump.

The Pump Station components are located on 3 different properties: Mid-Town Trackage Ventures, Scenic Hudson and Chapel of Our Lady Restoration. The Village has obtained appropriate permissions and easements from each of the involved property owners.

The work includes setting up temporary access controls around the work area, temporary by-pass of influent sewage, demolition of the existing below ground pump chamber, demolition of the above ground components, dewatering the excavation and sediment control, construction of a new below grade wetwell with submersible pumps and accessories, rehabilitation of the existing influent manhole, construction of new electrical service and control system with connecting conduits, backfilling all excavations, all testing start-up and adjustment necessary to have a functioning pumping station, restoring pavement disturbed during construction and restoring easement areas to acceptable conditions.

1.02 Administrative Requirements

The work shall include complying with the requirements of these contract documents, access permits and easement conditions. Important compliance issues include all safety requirements, Putnam County Contractor Licensing Laws, Prevailing Wage Law, etc.

PART 2 - Products.

None this section.

PART 3 - Execution

None this Section.

END OF SECTION

Section No. 01 55 00

Vehicular Access and Parking

PART 1 - General

1.01 Summary

The Pump Station is located in an accessway to a commuter parking area for MetroNorth Commuter Train Station. The Station sees fairly heavy traffic during the early morning and afternoon peak use times and is relatively quiet outside of those times. These traffic patterns must be respected by allowing traffic to continue to move in and out of the parking area, to perform heaviest work outside of heavy traffic times and storage of materials and equipment storage must be kept to a minimum.

Specific issues that must be addressed include:

- Construction workers may not park in the commuter spaces. Workers may park along the West side of Market St;
- Overnight and longer term storage of materials shall be kept to a minimum at the site. The Village offers the use of the Parking Area at the Village Garage as a storage area. The Contractor is also free to make arrangements for storage and/or parking on private property owners as they see fit.
- Excavated material should not be stored on-site;
- The work area shall have temporary fencing and signs needed to properly move vehicular and pedestrian traffic around the work area;

1.02 Price and Payment Procedures

Traffic Control, barriers and signs shall be one lump Sum Item.

1.03 Administrative Requirements

The Contractor shall coordinate efforts with the Village Police and MTA Police.

1.04 Informational submittals

The Contractor shall provide submittals to the engineer providing details on the fence system and signs to be used during construction.

1.05 Field or Site Conditions

PART 2 - Products.

2.01 Owner Furnished or Supplied Products

The owner will not provide any products for this work.

2.02 Temporary Fencing

- A. Fence Panels. Fence panels shall be 6' high by as long as 10'. The panels shall have a tubular frame with the appropriate hardware to securely connect one panel to another. The fence fabric may be welded wire or chain link.
- B. Panel Bases. The panel based shall be part of a coordinated temporary fencing system that allows for easy movement of the fence. The base shall be provided with ballast to provide a fence system that is stable in all weather conditions and cannot be moved inadvertently.

2.03 Traffic Control Devices.

- A. Hand signaling devices used to control traffic shall meet the requirements of the MUTCD. The standard signaling device shall be STOP/SLOW signal paddles in accordance with NYSDOT §729-05 Stop/Slow Paddles. Red signal flags shall be a minimum of 24 inch square.
- B. Traffic Signs including free standing signs shall meet the requirements of MUTCD.

PART 3 - Execution

3.01 Erection/installation/Application/etc

- A. All traffic control efforts shall be coordinated with the MTA prior to and during construction.

3.02 Maintenance

- A. All signs, fence and other traffic control devices are to be kept in good condition for the duration of the construction period.
- B. At the end of the construction period all devices are to be removed from the site.

END OF SECTION

Section 01 57 13

Temporary Erosion and Sediment Controls

PART 1 - General

1.01 Summary

This Section describes the materials and methods for temporary erosion and sediment controls. The primary source of sediments from the project will be dewatering the excavation and from spill of excavated materials on to the pavement surrounding the area of disturbance. The Contractor is expected to put into practice procedures to prevent sediment from becoming a problem to the commuter traffic and surrounding land owners. All collected sediment is to be disposed of off-site.

1.02 Price and Payment Procedures

The work included in this section will be paid for on a lump sum basis.

PART 2 - Products.

2.01 Filter Bags

A. Material Properties.

1. The Filter Bags shall be a non-woven bag which is sewn with a double needle matching using a high strength thread.
2. Each standard filter bag has a fill spout large enough to accommodate a 4" discharge hose. Attached are straps to secure the hose and prevent pumped water from escaping without being filtered.
3. The geotextile fabric shall be non-woven fabric with the following minimum properties:

Properties	Test Method	Units	Value
Weight	ASTM D-3776	Oz/yd	8
Grab Tensile	ASTM D-4632	Lbs.	203
Puncture	ASTM D-4833	Lbs.	130
Flow Rate	ASTM D-4491	Gal/Min/Ft2	80
Permittivity	ASTM D-4491	Sec.-1	1.5
Mullen	ASTM D-3786	Lbs.in2	400
Burst			
UV	ASTM D-4355	%	70
Resistant			
AOS %	ASTM D-4751	%	100
Retained			

- B. This specification is based on the DIRTBAG by ACF Environmental.

2.02 Erosion Eels

- A. This specification is based on the EROSION EEL by ACF Environmental.
- B. Erosion Eels have a Woven Polypropylene Geotextile Exterior and washed shredded rubber internal fill. Eels shall be no smaller than 9" in diameter and weigh approximately 15# per foot.
- C. AT least 40 LF of Eels shall be present on site at all times in order to be used as needed during periods of excavation.

2.03 Hay Bales

- A. Hay Bales shall consist of dried grass or straw mechanically compacted into a 14" H x 16" wide x approximately 30" long shape and held in that shape by 2 pieces of twine. The bales shall weigh approximately 30 to 50 lbs each. They shall be reasonably free of noxious weeds, sticks, or other debris. They shall not be excessively moldy.
- B. At least 20 bales should be on-site at all times in order to be used as may be needed by conditions in the field, or, at the direction of the engineer.
- C. The hay shall be stored off the ground and covered by a water proof tarp to prevent the bales from becoming wet before use.

PART 3 - Execution

- 3.01 Temporary Erosion Control measures shall be installed in accordance with the NYSDEC Guidelines for Erosion and Sediment Control, or, by manufacturer's instructions for the measure.

3.02 Maintenance

- A. Filter Bag: The Filter Bag is full when it no longer can efficiently filter sediment or pass water at a reasonable rate. Flow rates will vary depending on the size of the filter bag, the type and amount of sediment discharged into the Filter Bag, the type of ground, rock or other substance under the bag and the degree of the slope on which the bag lies. Under most circumstances Filter Bag will accommodate flow rates of 1500 gallons per minute. Use of excessive flow rates or overfilling Filter Bag with sediment will cause ruptures of the bags or failure of the hose attachment straps.
- B. Hay Bales Dams should be inspected after every storm. If they no longer effectively filter sediment they should be replaced.
- C. Temporary Mulch should be placed in areas to prevent erosion and/or tracking of sediment.
- D. Erosion Eels should be used on paved areas to prevent sediment from leaving the construction area. Remove sediment from behind Eels when $\frac{1}{4}$ to $\frac{1}{2}$ the height of the eel.

- E. Pavement Sweeping. The paved areas around the construction area shall be swept at least once per day when there is excavation activity that could track sediments on to the pavement, or, as directed by the Engineer. This shall be done by hand or power sweepers. Control Dust during sweeping activities by wetting the areas to be swept with water only.

3.03 Clean-up

- A. All sediment collected from the temporary measures shall be disposed of off site unless given permission to use on-site by the engineer.
- B. All temporary erosion control measures shall be removed from the site after serving its purpose, or, after the site has been stabilized.

END OF SECTION

Section 01 78 23

Operations and Maintenance Data

PART 1 - General

1.01 Summary

The Contractor shall prepare an Operation and Maintenance Manual for the Pump Station.

1.02 Price and Payment Procedures

There is no separate payment for this item of work.

1.03 Maintenance Material Submittals

- A. The contractor shall assemble all product data, maintenance manuals, warranties, as-built drawings etc into one manual for reference by the operators.
- B. The manual shall be in a heavy duty (3) D-ring binder with heavy duty tabs separating each section/product data. Each Tab shall be clearly labeled to subject. The exterior of the manual shall have a label which clearly indicates, the Client name, project name, the contents of the manual and date the manual was prepared. The binders shall be large enough to easily fit all product data and allow the addition of further information by the operators.
- C. Three identical manuals shall be provided.
- D. The manuals will be reviewed to determine completeness and how adequately they serve the purpose of these specifications.

PART 2 - Products.

None This Section

PART 3 - Execution

None this section

END OF SECTION

Section No. 01 79 00

Demonstration and Training

PART 1 - General

1.01 Summary

This section is to describe the activities required to provide for Demonstrating that the equipment installed functions as intended and for training the operators to use the equipment and perform basic maintenance on the equipment installed.

1.02 Price and Payment Procedures

No Separate payment is made for this item.

PART 2 - Products.

None This Section

PART 3 - Execution

3.01 System Start-up and Demonstration

- A. The Contractor shall provide the water needed to demonstrate the operation of the pumps.
- B. Authorized Representative for the pumps, control system and alarm notification device shall be on hand to inspect the installation, make needed adjustments, start the system and determine that all conditions have been met to make the warrantee valid.
- C. Specific Start-up requirements are identified in the individual specifications for each system.

3.02 Training

- A. The contractor shall provide personnel authorized by the manufacturer to review the operations for the control panel and the alarm notification device. This will include discussion about fixing faults, acknowledging alarms and working with the alarm system website to monitor the operation of the pumps and setup calling lists, communications quality monitoring, etc.. At least one test alarm shall be made to verify operation.
- B. One two-hour session shall be held by the authorized representative at least one week after start-up to review the operations of the Pump Station Monitor.

END OF SECTION

Section 02 01 00

Maintenance of Existing Conditions

PART 1 - General

1.01 Summary

Maintenance of existing conditions is especially important on this job site because three property owners are being dealt with, flows in the existing sewers must be maintained and traffic into and out of the commuter parking area must be maintained.

1.02 Price and Payment Procedures

No separate pay item exists for this Section.

1.03 Field or Site Conditions

A. As part of the preconstruction meeting, the contractor will photograph the existing conditions of the site paying close attention to the driveway and retaining wall on the Chapel, the Driveway at the Scenic Hudson property, the landscape hedge at Scenic Hudson and all improvements on the MTA parking area including pavement conditions. Copies of this record of existing conditions will be provided to the Owner and Engineer.

B. Any damage to existing landscaping or hardscaping such as walls, driveways, curbs, lighting, etc will be repaired by the Contractor..

1.04 Maintenance of Flow. The sewer leading to the pump station will remain active during construction. The flows are generally small because 9 residences are connected to the sewer. The contractor must maintain the flow in the sewer. The Contractor shall submit a maintenance of flow plan prior to any work being done that could interrupt the flow. On going removal of the sewage using Vactor trucks is not acceptable. Methods of flow control that are acceptable include:

A. By-Pass Pumping: Due to the amount of commuter traffic in the area, by-pass pumping to a downstream manhole with piping on the surface doesn't appear feasible. However, appropriate planning may make this workable.

B. Temporary Pumping into the existing force main: The contractor may connect a temporary pump into the existing force main and use the existing control system to operate the pump. All details of this approach shall be provided with the maintenance of flow plan.

C. Other methods may be proposed by the contractor for review and approval.

PART 2 - Products

2.01 High Level Alarm

A. An alarm system using cellular communication technology will be used in the manhole upstream of the pump station manhole.

- B. This alarm system will serve as warning that a backup of sewage into an existing house is about to occur.
- C. The Alarm shall be equal to Mission Communications system model M-80 in all ways.
- D. The alarm will be removed from the manhole at the end of the project and become property of the Village.

PART 3 - Execution

None This Section.

END OF SECTION

Section 31 23 16.26

Rock Removal

PART 1 - General

1.01 Summary

- A. The work included in this Section is to furnish all equipment, supplies and labor necessary for the excavation and disposal of rock encountered in the excavation of structures and trenching for utilities.
- B. There are no borings done on the site; however, most of the work is being done in previously excavated areas. So, rock excavation is expected to be minimal. The opportunity for rock is present at the edges of excavations, undocumented concrete ballast and areas for new trenching.

1.02 Price and Payment Procedures

- A. This work shall be done on a unit price basis. The cost for this work shall be included in the Bid item for Rock Removal.
- B. The quantity for rock removal shall be established by measurements made by the engineer in the field to determine the volume of rock in place. In areas where rock is extensive, the volume of rock shall be determined through the use of pre- and post-surveys completed by a surveyor.

1.03 Definitions

- A. Rock excavation shall mean removal of rock that requires drilling and blasting, hammering, ripping or other similar means. Heavy Rubble masonry, large pieces of concrete pavement or sidewalk and other large solid pieces of rubble shall be considered as being rock.
- B. Boulders that are greater than 1.5 Cubic yard in volume, or, larger which can be excavated without the above removal techniques, will also be considered as rock if they must be reduced in size to transport and disposed of properly.

PART 2 - Products.

None This Section

PART 3 - Execution

3.01 Preparation

- A. Before Rock removal begins, the contractor shall determine the limits of excavation necessary. The limits shall generally be indicated by the details on the plans showing excavation. The contractor and Engineer shall discuss the limits of excavation in the field prior to beginning rock excavation and mutually agree to a limit of excavation.

- B. Excavation that goes beyond these limits, shall be considered excess excavation. Additionally, at the bottom of excavations, if the excavation is deeper than necessary due to holes drilled too deep, explosive charges that are heavier than needed, shall also be considered excess excavation if the material that remains is not suitable foundation material. The additional space shall be refilled at the Contractor's expense in a manner specified for the type of structure or trench being excavated.

3.02 Installation

A. Blasting

1. All blasting operations shall be in full compliance with all Federal, State and local laws and ordinances. This includes storage and handling of explosives.
2. No blasting shall be permitted unless all permits, permission and notifications have been obtain and/or made to authorities having jurisdiction including local residences, businesses, Local Government, their building Departments, water, sewer, electric, gas, communications or other utilities in the project area.
3. Care should be taken to avoid damage to utilities, structures and other properties. Damages and costs of whatever nature resulting from blasting operations shall be borne solely by the contractor.

B. Hammering

1. Hydraulic Hammers may be used if the type of rock and extent of excavation indicate that this method would be productive.
2. The contractor should use other methods of excavation, if extended periods of hammering would be needed to accomplish the excavation needed. This is to limit the impact on the neighborhood from noise, etc.

C. Disposal of Rock

1. The contractor shall remove all rock that is not suitable for use in backfill of the excavation.
2. During the excavation and Disposal of the Rock, the contractor shall provide for adequate dust control by watering the excavated area..

END OF SECTION

Section 33 31 00

Sanitary Utility Sewage Piping

PART 1 - General

1.01 Summary

- A. The work included in this Section is to furnish, install and test the various kinds, types, classes and sizes of pipe and fittings required for the construction gravity and pressure sewer (force main) piping indicated on the plans.
- B. Work concerning excavation is described in NYSDOT Standard Specifications Section 206, "Trench, Culvert and Structure Excavation".

1.02 Price and Payment Procedures

- A. The work in this section will be paid for under one or more of the lump sum bid items.

1.03 Informational submittals

- A. Product data will be provided for each item that the contractor intends to supply.

PART 2 - Products.

2.01 PVC Gravity pipe and fittings

- A. Acceptable Manufacturers – Any manufacturer that has a successful history of conforming with standards and requirements below.
- B. Operation Requirements and Dimensions
 - 1. The pipe shall be the diameter specified on the plans.
 - 2. Follow the manufacturer's recommended handling, storage and installation procedures.
- C. Materials Components and finish
 - 1. Pipe shall have a wall thickness ratio of SDR-35 conforming with ASTM D3034. Each length of pipe shall have an integral bell and be supplied in standard laying lengths.
 - 2. All fittings shall be the same material as the pipe and have provisions for expansion and contraction at each joint with an elastomeric ring. All fittings and accessories are manufactured and furnished by the pipe supplier or approved equal.
 - 3. Joints on both pipe and fittings shall comply with ASTM D3212, be a push-on type using elastomeric gaskets designed to prevent slipping during after assembling the joint, have gaskets installed and secured in place at the factory.
 - 4. Gasket by spigot end fittings shall be used where ever possible and oriented in the direction of flow..

2.02 Ductile Iron Pressure Pipe and Fittings

- A. Acceptable Manufacturers – Any manufacturer that has an established history of meeting these specifications.
- B. Operation Requirements and Dimensions
 - 1. All ductile iron pipe shall be mechanical joint pipe.
 - 2. The pipe shall be the diameter indicated on the plan.
- C. Materials, Components and Fittings.
 - 1. Pipe shall conform to ANSI A21.51/ AWWA C151 Class 52.
 - 2. Mechanical Joint fittings shall be ductile iron conforming to ANSI A21.10 / AWWA C110.
 - 3. Pipe fitting joint Hub shall meet ANSI A 21.11/ AWWA C111 standards and shall include gaskets.
 - 4. Pipe and fittings shall be double cement lined and seal coated inside and out in conformance with ANSI A21.4/ AWWA C104.
 - 5. All joints shall be assembled using ductile iron retainer glands with torque limiting set screws, Megalug 1100 or equal.

2.03 Mechanical Joint Plug Valve

- A. Acceptable manufacturers – Manufacturer shall be Valmatic 5800 series plug valve or approved equal.
- B. Operational Requirements and Dimensions
 - 1. A plug valve is being specified in order to provide a valve with a consistent shut-off in a sewage application.
 - 2. The Valve shall be the diameter indicated on the plan.
 - 3. The valve shall open Counter Clockwise.
- C. Materials Components and Finish
 - 1. The Valve body shall be Cast and/or Ductile Iron.
 - 2. The sealing portions of the Valve shall be BUNA-n.
 - 3. The body shall have a rust inhibiting powder and/or epoxy coating suitable for direct bury.
 - 4. The valve shall be wrapped in utility tape after assembly prior to burial.

PART 3 - Execution

3.01 Delivery, Storage and Handling

- A. Deliver materials to the job site in good condition and properly protected against damage to finished surfaces, with manufacturer's original packaging, with all tags and labels in tact and legible.
- B. Store materials and equipment at acceptable locations in accordance with manufacturer's recommendations. If possible store required equipment and materials indoors and in a location and manner to avoid damage.
- C. The contractor shall furnish slings straps and/or other approved method /devices to support the pipe. Pipe and fittings shall not be dropped from truck or into any excavation. Transporting pipe shall be done in a manner to prevent damage to the pipe.
- D. All pipe and fittings shall be examined before laying and no pipe or fitting shall be installed which are found to be defective. Damaged pipe coatings and/or linings (if any) shall be repaired as approved or directed by the Engineer.
- E. Any pipe showing a distinct crack with no evidence of incipient fracture beyond the limits of the visible crack may have the cracked portion cut-off if approved by the engineer. The cut shall be made in the sound portion of the barrel at least 12" from the visible limit of the crack.

3.02 Installation

A. Control of alignment and grade

1. Survey Control data:

- a) The contractor shall be aware of Easement, Property and other control lines necessary for locating the work. If requested by the contractor, property and easement lines will be "staked-out" by the Owner. The contractor shall be responsible for maintaining good and cooperative relationship with the surrounding owners.
- b) The surveyor has established a bench mark and this data will be provided to the successful bidder.
- c) The contractor shall not proceed until he has made timely request of the Engineer for , and has received such controls and instructions as may be necessary as the work progresses.
- d) The contractor shall preserve bench marks, reference points and stakes. In the case of willful careless or accidental destruction by his own men, he will be responsible for the resulting expense to re-establish such destroyed data. The contractor shall be responsible for any mistakes or delays that may be caused by the loss or disturbance of this control data.

- 2. The contractor may use laser equipment to assist in setting the pipe provided that the necessary skill needed can be demonstrated.
- 3. The use of string level, hand levels, carpenter levels or other similar devices for transferring grade will not be permitted.

4. The Contractor shall maintain good alignment in laying the pipe. Deflection at joints if necessary, shall not exceed the manufacturer's recommended limit. If required, the contractor shall provide additional fittings, in addition to those shown on the drawings if deflection beyond this limit is necessary due to utility crossings, changes in direction for the convenience of the contractor, etc.

B. Installing Pipe and Fittings

1. The contractor shall have on the job site and with each pipe laying crew all the proper tools to handle and cut the pipe.
2. All pipe and fittings shall be thoroughly cleaned before laying and kept cleaned until installed.
3. If any defective pipe is discovered after it has been laid, the Contractor shall remove the defective pipe and replace it with sound pipe at no additional cost to the owner.
4. In general, gravity pipe laying shall proceed up grade from the discharge point to inlet. Spigot ends shall point in the direction of flow.
5. Pipe shall be laid in dry, firm and unyielding conditions. At no time shall water in the trench be allowed to flow into the pipe. At any time that work is not in progress, the end of the pipe shall be suitably closed to prevent the entry of animals, earth, water, etc. Approved plugs shall be used.
6. Lay pipe and fittings in accordance with the requirements of AWWA C600, except as provided in these specifications. Pvc Pipe shall not be installed when the temperature is below 32°F unless approved by the engineer.
7. Excavation and backfill shall conform to applicable sections of the NYSDOT Standard Specifications Section 203 and 206.
8. As soon as excavation has been completed to the proper depth, the pipe bed shall be prepared as follows:
 - a) Place and compact bedding materials to establish a minimum of 6" under the pipe bell and bring the pipe grade to the elevation specified.
 - b) Dig holes for the pipe bell, fitting, valves, etc of adequate length for pipe joining.
 - c) Shape the bedding materials so that the bottom quarter of the pipe rest firmly on the bedding for the entire length of the barrel.
 - d) Blocking under the pipe and then placing bedding under the blocked up pipe is not permitted.(Note: unless a permanent concrete cradle is specified).
9. Each section of pipe shall be placed into position in a manner and by such means required to avoid injury to persons, any property or the pipe.
10. Assembling of the pipe joints shall conform to the manufacturer's recommendations and or appropriate ASTM or AWWA standards.
11. When cutting of the pipe is required, the cutting shall be done by machine without

damage to the pipe or cement lining (if any). Cut ends will be smooth, at right angles to the pipe and beveled-and-filed, or, ground smooth to conform to a manufactured spigot end.

12. Any debris, tools etc shall be removed from the pipe.
13. After placing the pipe on the lower bedding, the bedding material may be brought to the elevation specified in the trench detail and compacted.
14. The pipe shall be re-checked for alignment and grade. If the proper grade and alignment has been achieved, the pipe may then back fill the remainder of the trench in accordance with NYSDOT Specifications 203 and 206 and the details on the drawings.
15. If unsatisfactory work is discovered during inspections, that work shall be dug up and reinstalled to meet the requirements of the contract documents. No additional time for completion will be allowed..

3.03 Quality Control

A. The following tests shall be performed on gravity flow pipes:

1. Infiltration, Low pressure air or exfiltration;
2. Deflection test (at the discretion of the engineer);
3. Video Inspection and laser profiling (at the discretion of the engineer if other testing shows a failing system).

B. The following test shall be performed on pressure flow pipes:

1. Pressure testing.

C. The following procedures should be followed if any pipe sections do not pass the required testing procedures:

1. The failure shall be diagnosed to determine the likely cause of the problem;
2. The contractor shall propose a method for repair of the failed section. The use of sealants applied from inside the pipe is not an acceptable repair;
3. If directed by the Engineer, the contractor shall dig up and re-lay the failed section at no additional cost to the owner and with no extension of the contract time allowed for completion.

D. Testing Procedures

1. Infiltration –

- a) May be used when the groundwater level is more than 2 ft above the crown of the pipe at the upper end of the pipe section.
- b) Plug the upper end of the pipe section to be tested.

- c) Install a V-notch Weir at the lower end of the pipe section calibrated to match the maximum flow anticipated below.
 - d) The leakage must be less than 25 gallons/day/in-diameter/mile of pipe.
- 2. Exfiltration test
 - a) May be conducted when ground water is less than 2 ft above the crown at the highest point of the pipe;
 - b) Plug the lower end of the pipe, the plug shall allow for introduction of water and plug the upper end with a plug that allows air to be expelled;
 - c) Add water from the lower end until the water is at least 4 ft above the highest groundwater level or 4 ft higher than the crown at the highest end;
 - d) Allow a 2 hr period to allow for absorption and trapped air to be expelled;
 - e) Refill the pipe to the original level, note the level of the water;
 - f) After no less than 4 hours, measure the height of the water and then calculation the volume of water lost;
 - g) The leakage must be less than 25 gallons/day/in-diameter/mile of pipe.
- 3. Low pressure Air
 - a) The procedures of ASTM C828-86 shall be followed;
- 4. Deflection Test
 - a) The deflection test is to determine if the pipe has deflected from a round condition or any bends have occurred in the pipe.
 - b) Optional methods for deflection include calibrate television or laser profiling, properly sized "Go-No-Go" mandrel, Sewer Ball or deflectometer.
 - c) The maximum pipe deflection is 5%.
 - d) Deflection test should be performed no sooner than 30-days after installation.
- 5. Pressure Testing
 - a) Testing shall be done in accordance with AWWA C600, except as amended or added below:
 - b) Water to be furnished by the Contractor;
 - c) Test duration 2 hours;
 - d) Test pressure shall be 150% of the operating pressure, but no less than 50 psi and no more than 300 psi;

- e) The Pressure may not drop more than 5 psi during the duration of the test;
- f) The allowable leakage is calculated with the following formula

$$L = S D (P)^{1/2} / 133,200$$

L is in gallons; S length of pipe in feet; D is nominal diameter in inches; P in PSI

- g) .

END OF SECTION

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Section 26 05 00 Common Work Results For Electrical

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:

1. Electrical equipment coordination and installation.
2. Sleeves for raceways and cables.
3. Sleeve seals.
4. Grout.
5. Common electrical installation requirements.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 COORDINATION

- A. Coordinate arrangement, mounting, and support of electrical equipment:
 1. To provide for ease of disconnecting the equipment with minimum interference to other installations.
 2. To allow right of way for piping and conduit installed at required slope.
 3. So connecting raceways, cables, wireways, cable trays, and busways will be clear of obstructions and of the working and access space of other equipment.
- B. Coordinate installation of required supporting devices and set sleeves in cast-in-place concrete, masonry walls, and other structural components as they are constructed.

PART 2 - PRODUCTS

2.01 SLEEVES FOR RACEWAYS AND CABLES

- A. Steel Pipe Sleeves: ASTM A 53/A 53M, Type E, Grade B, Schedule 40, galvanized steel, plain ends.

- B. Cast-Iron Pipe Sleeves: Cast or fabricated "wall pipe," equivalent to ductile-iron pressure pipe, with plain ends and integral waterstop, unless otherwise indicated.

2.02 SLEEVE SEALS

- A. Sealing Elements: EPDM interlocking links shaped to fit surface of cable or conduit. Include type and number required for material and size of raceway or cable.
- B. Pressure Plates: Plastic. Include two for each sealing element.
- C. Connecting Bolts and Nuts: Stainless steel of length required to secure pressure plates to sealing elements. Include one for each sealing element.

2.03 GROUT

- A. Nonmetallic, Shrinkage-Resistant Grout: ASTM C 1107, factory-packaged, nonmetallic aggregate grout, noncorrosive, nonstaining, mixed with water to consistency suitable for application and a 30-minute working time.

PART 3 - EXECUTION

3.01 COMMON REQUIREMENTS FOR ELECTRICAL INSTALLATION

- A. Comply with NECA 1.
- B. Equipment: Install to facilitate service, maintenance, and repair or replacement of components of both electrical equipment and other nearby installations. Connect in such a way as to facilitate future disconnecting with minimum interference with other items in the vicinity.
- C. Right of Way: Give to piping systems installed at a required slope.

3.02 SLEEVE INSTALLATION FOR ELECTRICAL PENETRATIONS

- A. Electrical penetrations occur when raceways, cables, wireways, cable trays, or busways penetrate concrete slabs, concrete or masonry walls, or fire-rated floor and wall assemblies.
- B. Concrete Slabs and Walls: Install sleeves for penetrations unless core-drilled holes or formed openings are used. Install sleeves during erection of slabs and walls.
- C. Use pipe sleeves unless penetration arrangement requires rectangular sleeved opening.
- D. Cut sleeves to length for mounting flush with both surfaces of walls.
- E. Extend sleeves installed in floors 1 inch above finished floor level.
- F. Size pipe sleeves to provide 1/4 inch annular clear space between sleeve and raceway or cable, unless indicated otherwise.

- G. Seal space outside of sleeves with grout for penetrations of concrete and masonry
 - 1. Promptly pack grout solidly between sleeve and wall so no voids remain. Tool exposed surfaces smooth; protect grout while curing.
- H. Aboveground, Exterior-Wall Penetrations: Seal penetrations using cast-iron pipe sleeves and mechanical sleeve seals. Select sleeve size to allow for 1-inch annular clear space between pipe and sleeve for installing mechanical sleeve seals.
- I. Underground, Exterior-Wall Penetrations: Install cast-iron pipe sleeves. Size sleeves to allow for 1-inch annular clear space between raceway or cable and sleeve for installing mechanical sleeve seals.

3.03 SLEEVE-SEAL INSTALLATION

- A. Install to seal exterior wall penetrations.
- B. Use type and number of sealing elements recommended by manufacturer for raceway or cable material and size. Position raceway or cable in center of sleeve. Assemble mechanical sleeve seals and install in annular space between raceway or cable and sleeve. Tighten bolts against pressure plates that cause sealing elements to expand and make watertight seal.

END OF SECTION

Section 26 05 19 Low-Voltage Electrical Power Conductors and Cables

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes the following:
 - 1. Building wires and cables rated 600 V and less.
 - 2. Connectors, splices, and terminations rated 600 V and less.

1.03 DEFINITIONS

- A. EPDM: Ethylene-propylene-diene terpolymer rubber.
- B. NBR: Acrylonitrile-butadiene rubber.

1.04 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For testing agency.
- C. Field quality-control test reports.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.
 - 1. Testing Agency's Field Supervisor: Person currently certified by the InterNational Electrical Testing Association or the National Institute for Certification in Engineering Technologies to supervise on-site testing specified in Part 3.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

- C. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 CONDUCTORS AND CABLES

- A. Copper Conductors: Comply with NEMA WC 70.
- B. Conductor Insulation: Comply with NEMA WC 70 for Types THHN-THWN and SO.
- C. Multiconductor Cable: Comply with NEMA WC 70 for Type SO with ground wire.

2.02 CONNECTORS AND SPLICES

- A. Description: Factory-fabricated connectors and splices of size, ampacity rating, material, type, and class for application and service indicated.

PART 3 - EXECUTION

3.01 CONDUCTOR MATERIAL APPLICATIONS

- A. Feeders: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.
- B. Branch Circuits: Copper. Solid for No. 10 AWG and smaller; stranded for No. 8 AWG and larger.

3.02 CONDUCTOR INSULATION AND MULTICONDUCTOR CABLE APPLICATIONS AND WIRING METHODS

- A. Service Entrance: Type THHN-THWN, single conductors in raceway.
- B. Feeders Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway.
- C. Branch Circuits Concealed in Concrete, below Slabs-on-Grade, and Underground: Type THHN-THWN, single conductors in raceway..
- D. Control Floats: Type SO, hard service cord with stainless-steel, wire-mesh, strain relief device at terminations to suit application.

3.03 INSTALLATION OF CONDUCTORS AND CABLES

- A. Use manufacturer-approved pulling compound or lubricant where necessary; compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

- B. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
- C. Install exposed cables parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
- D. Identify and color-code conductors and cables according to Division 26 Section "Identification for Electrical Systems."

3.04 CONNECTIONS

- A. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.
- B. Make splices and taps that are compatible with conductor material and that possess equivalent or better mechanical strength and insulation ratings than unspliced conductors.
- C. Wiring at Outlets: Install conductor at each outlet, with at least 6 inches of slack.

3.05 FIELD QUALITY CONTROL

- A. Tests and Inspections:
 - 1. After installing conductors and cables and before electrical circuitry has been energized, test all conductors for compliance with requirements.
 - 2. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
- B. Test Reports: Prepare a written report to record the following:
 - 1. Test procedures used.
 - 2. Test results that comply with requirements.
 - 3. Test results that do not comply with requirements and corrective action taken to achieve compliance with requirements.
- C. Remove and replace malfunctioning units and retest as specified above.

END OF SECTION

Section 26 05 26 Grounding and Bonding for Electrical Systems

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes: Grounding systems and equipment.
- B. Section includes grounding systems and equipment, plus the following special applications:
 - 1. Underground distribution grounding.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated.
- B. Qualification Data: For qualified testing agency and testing agency's field supervisor.
- C. Field quality-control reports.
- D. Operation and Maintenance Data: For grounding to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Instructions for periodic testing and inspection of grounding features at grounding connections for separately derived systems based on NFPA 70B.
 - a. Tests shall determine if ground-resistance or impedance values remain within specified maximums, and instructions shall recommend corrective action if values do not.
 - b. Include recommended testing intervals.

1.04 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.

- C. Comply with UL 467 for grounding and bonding materials and equipment.

PART 2 - PRODUCTS

2.01 CONDUCTORS

- A. Insulated Conductors: Copper wire or cable insulated for 600 V unless otherwise required by applicable Code or authorities having jurisdiction.
- B. Bare Copper Conductors:
 - 1. Solid Conductors: ASTM B 3.
 - 2. Stranded Conductors: ASTM B 8.
 - 3. Bonding Conductor: No. 4 or No. 6 AWG, stranded conductor.
 - 4. Bonding Jumper: Copper tape, braided conductors terminated with copper ferrules; 1-5/8 inches wide and 1/16 inch thick.

2.02 CONNECTORS

- A. Listed and labeled by an NRTL acceptable to authorities having jurisdiction for applications in which used and for specific types, sizes, and combinations of conductors and other items connected.
- B. Bolted Connectors for Conductors and Pipes: Copper or copper alloy, pressure type with at least two bolts.
 - 1. Pipe Connectors: Clamp type, sized for pipe.
- C. Welded Connectors: Exothermic-welding kits of types recommended by kit manufacturer for materials being joined and installation conditions.

2.03 GROUNDING ELECTRODES

- A. Ground Rods: Copper-clad, 3/4 inch by 10 feet in diameter.

PART 3 - EXECUTION

3.01 APPLICATIONS

- A. Conductor Terminations and Connections:
 - 1. Pipe and Equipment Grounding Conductor Terminations: Bolted connectors.
 - 2. Underground Connections: Welded connectors except at test wells and as otherwise indicated.
 - 3. Connections to Ground Rods at Test Wells: Bolted connectors.
 - 4. Connections to Structural Steel: Welded connectors.

3.02 GROUNDING UNDERGROUND DISTRIBUTION SYSTEM COMPONENTS

- A. Comply with IEEE C2 grounding requirements.
- B. Grounding Connections to Manhole Components: Bond exposed-metal parts such as inserts, cable racks, pulling irons, ladders, and cable shields within each manhole or handhole, to ground rod or grounding conductor. Make connections with No. 4 AWG minimum, stranded, hard-drawn copper bonding conductor. Train conductors level or plumb around corners and fasten to manhole walls. Connect to cable armor and cable shields according to written instructions by manufacturer of splicing and termination kits.
- C. Pad-Mounted Transformers and Switches: Install two ground rods and ground ring around the pad. Ground pad-mounted equipment and noncurrent-carrying metal items associated with substations by connecting them to underground cable and grounding electrodes. Install tinned-copper conductor not less than No. 2 AWG for ground ring and for taps to equipment grounding terminals. Bury ground ring not less than 6 inches from the foundation.

3.03 EQUIPMENT GROUNDING

- A. Install insulated equipment grounding conductors with all feeders and branch circuits.
- B. Install insulated equipment grounding conductors with the following items, in addition to those required by NFPA 70:
 - 1. Feeders and branch circuits.
 - 2. Lighting circuits.
 - 3. Receptacle circuits.
 - 4. Single-phase motor and appliance branch circuits.
 - 5. Three-phase motor and appliance branch circuits.
 - 6. Flexible raceway runs.
 - 7. Armored and metal-clad cable runs.

3.04 INSTALLATION

- A. Grounding Conductors: Route along shortest and straightest paths possible unless otherwise indicated or required by Code. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.
- B. Ground Rods: Drive rods until tops are 2 inches below finished floor or final grade unless otherwise indicated.
 - 1. Interconnect ground rods with grounding electrode conductor below grade and as otherwise indicated. Make connections without exposing steel or damaging coating if any.
 - 2. For grounding electrode system, install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes, and connect to the service grounding electrode conductor.
- C. Bonding Straps and Jumpers: Install in locations accessible for inspection and maintenance except where routed through short lengths of conduit.

1. Bonding to Structure: Bond straps directly to basic structure, taking care not to penetrate any adjacent parts.
2. Bonding to Equipment Mounted on Vibration Isolation Hangers and Supports: Install bonding so vibration is not transmitted to rigidly mounted equipment.
3. Use exothermic-welded connectors for outdoor locations; if a disconnect-type connection is required, use a bolted clamp.

D. Grounding and Bonding for Piping:

1. Metal Water Service Pipe: Install insulated copper grounding conductors, in conduit, from building's main service equipment, or grounding bus, to main metal water service entrances to building. Connect grounding conductors to main metal water service pipes; use a bolted clamp connector or bolt a lug-type connector to a pipe flange by using one of the lug bolts of the flange. Where a dielectric main water fitting is installed, connect grounding conductor on street side of fitting. Bond metal grounding conductor conduit or sleeve to conductor at each end.
2. Bond each aboveground portion of gas piping system downstream from equipment shutoff valve.

3.05 LABELING

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems" Article for instruction signs. The label or its text shall be green.

3.06 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Tests and Inspections:
 1. After installing grounding system but before permanent electrical circuits have been energized, test for compliance with requirements.
 2. Inspect physical and mechanical condition. Verify tightness of accessible, bolted, electrical connections with a calibrated torque wrench according to manufacturer's written instructions.
 3. Test completed grounding system at each location where a maximum ground-resistance level is specified, at service disconnect enclosure grounding terminal. Make tests at ground rods before any conductors are connected.
 - a. Measure ground resistance no fewer than two full days after last trace of precipitation and without soil being moistened by any means other than natural drainage or seepage

- and without chemical treatment or other artificial means of reducing natural ground resistance.
- b. Perform tests by fall-of-potential method according to IEEE 81.
- 4. Prepare dimensioned Drawings locating each test well, ground rod and ground-rod assembly, and other grounding electrodes. Identify each by letter in alphabetical order, and key to the record of tests and observations. Include the number of rods driven and their depth at each location, and include observations of weather and other phenomena that may affect test results. Describe measures taken to improve test results.
- E. Grounding system will be considered defective if it does not pass tests and inspections.
- F. Prepare test and inspection reports.
- G. Report measured ground resistances that exceed the following values:
 - 1. Power and Lighting Equipment or System with Capacity of 500 kVA and Less: 10 ohms.
- H. Excessive Ground Resistance: If resistance to ground exceeds specified values, notify Engineer promptly and include recommendations to reduce ground resistance.

END OF SECTION

Section 26 05 33 Raceway and Boxes for Electrical Systems

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.

1.03 DEFINITIONS

- A. EMT: Electrical metallic tubing.
- B. ENT: Electrical nonmetallic tubing.
- C. EPDM: Ethylene-propylene-diene terpolymer rubber.
- D. FMC: Flexible metal conduit.
- E. IMC: Intermediate metal conduit.
- F. LFMC: Liquidtight flexible metal conduit.
- G. LFNC: Liquidtight flexible nonmetallic conduit.
- H. NBR: Acrylonitrile-butadiene rubber.
- I. RNC: Rigid nonmetallic conduit.

1.04 SUBMITTALS

- A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

1.05 QUALITY ASSURANCE

- A. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- B. Comply with NFPA 70.

PART 2 - PRODUCTS

2.01 METAL CONDUIT AND TUBING

- A. Rigid Steel Conduit: ANSI C80.1.
- B. IMC: ANSI C80.6.
- C. PVC-Coated Steel Conduit: PVC-coated rigid steel conduit.
 - 1. Comply with NEMA RN 1.
 - 2. Coating Thickness: 0.040 inch minimum.
- D. EMT: ANSI C80.3.
- E. FMC: Aluminum.
- F. LFMC: Flexible steel conduit with PVC jacket.
- G. Fittings for Conduit (Including all Types and Flexible and Liquidtight), EMT, and Cable: NEMA FB 1; listed for type and size raceway with which used, and for application and environment in which installed.
 - 1. Conduit Fittings for Hazardous (Classified) Locations: Comply with UL 886.
 - 2. Fittings for EMT: Steel type.
 - 3. Coating for Fittings for PVC-Coated Conduit: Minimum thickness, 0.040 inch, with overlapping sleeves protecting threaded joints.
- H. Joint Compound for Rigid Steel Conduit or IMC: Listed for use in cable connector assemblies, and compounded for use to lubricate and protect threaded raceway joints from corrosion and enhance their conductivity.

2.02 NONMETALLIC CONDUIT AND TUBING

- A. RNC: NEMA TC 2, Type EPC 40 PVC, unless otherwise indicated.
- B. LFNC: UL 1660.
- C. Fittings for RNC: NEMA TC 3; match to conduit or tubing type and material.
- D. Fittings for LFNC: UL 514B.

2.03 METAL WIREWAYS

- A. Description: Sheet metal sized and shaped as indicated, NEMA 250, Type 1, unless otherwise indicated.
- B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.

- C. Wireway Covers: Flanged and gasketed type.
- D. Finish: Manufacturer's standard enamel finish.

2.04 BOXES, ENCLOSURES, AND CABINETS

- A. Sheet Metal Outlet and Device Boxes: NEMA OS 1.
- B. Cast-Metal Outlet and Device Boxes: NEMA FB 1, aluminum, Type FD, with gasketed cover.
- C. Small Sheet Metal Pull and Junction Boxes: NEMA OS 1.
- D. Cast-Metal Access, Pull, and Junction Boxes: NEMA FB 1, cast aluminum with gasketed cover.
- E. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous-hinge cover with flush latch, unless otherwise indicated.
 - 1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
- F. Cabinets:
 - 1. NEMA 250, Type 4, stainless steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel.
 - 2. Hinged door in front cover with flush latch and concealed hinge.
 - 3. Key latch to match panelboards.
 - 4. Metal barriers to separate wiring of different systems and voltage.
 - 5. Accessory feet where required for freestanding equipment.

2.05 HANDHOLES AND BOXES FOR EXTERIOR UNDERGROUND WIRING

- A. Polymer-Concrete Handholes and Boxes with Polymer-Concrete Cover: Molded of sand and aggregate, bound together with polymer resin, and reinforced with steel or fiberglass or a combination of the two.
- B. Fiberglass Handholes and Boxes: Molded of fiberglass-reinforced polyester resin, with covers of polymer concrete.

PART 3 - EXECUTION

3.01 RACEWAY APPLICATION

- A. Outdoors: Apply raceway products as specified below, unless otherwise indicated:
 - 1. Exposed Conduit: Rigid steel conduit.
 - 2. Concealed Conduit, Aboveground: Rigid steel conduit.
 - 3. Underground Conduit: RNC, Type EPC 40 PVC, direct buried, or rigid steel conduit.
 - 4. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
 - 5. Boxes and Enclosures, Aboveground: NEMA 250, Type 4.

- B. Minimum Raceway Size: 1/2-inch trade size.
- C. Raceway Fittings: Compatible with raceways and suitable for use and location.
 - 1. Rigid and Intermediate Steel Conduit: Use threaded rigid steel conduit fittings, unless otherwise indicated.
 - 2. PVC Externally Coated, Rigid Steel Conduits: Use only fittings listed for use with that material. Patch and seal all joints, nicks, and scrapes in PVC coating after installing conduits and fittings. Use sealant recommended by fitting manufacturer.
- D. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in nonmetallic sleeve.

3.02 INSTALLATION

- A. Comply with NECA 1 for installation requirements applicable to products specified in Part 2 except where requirements on Drawings or in this Article are stricter.
- B. Complete raceway installation before starting conductor installation.
- C. Arrange stub-ups so curved portions of bends are not visible above the finished slab.
- D. Install no more than the equivalent of three 90-degree bends in any conduit run except for communications conduits, for which fewer bends are allowed.
- E. Conceal conduit and EMT within finished walls, ceilings, and floors, unless otherwise indicated.
- F. Raceways Embedded in Slabs:
 - 1. Run conduit larger than 1-inch trade size, parallel or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
 - 2. Arrange raceways to cross building expansion joints at right angles with expansion fittings.
- G. Threaded Conduit Joints, Exposed to Wet, Damp, Corrosive, or Outdoor Conditions: Apply listed compound to threads of raceway and fittings before making up joints. Follow compound manufacturer's written instructions.
- H. Raceway Terminations at Locations Subject to Moisture or Vibration: Use insulating bushings to protect conductors, including conductors smaller than No. 4 AWG.
- I. Install pull wires in empty raceways. Use polypropylene or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of pull wire.
- J. Install raceway sealing fittings at suitable, approved, and accessible locations and fill them with listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:
 - 1. Where conduits pass from warm to cold locations, such as boundaries of refrigerated spaces.
 - 2. Where otherwise required by NFPA 70.

- K. Flexible Conduit Connections: Use maximum of 36 inches of flexible conduit for recessed and semirecessed lighting fixtures, equipment subject to vibration, noise transmission, or movement; and for transformers and motors.
 - 1. Use LFMC in damp or wet locations subject to severe physical damage.
 - 2. Use LFMC or LFNC in damp or wet locations not subject to severe physical damage.

3.03 INSTALLATION OF UNDERGROUND CONDUIT

A. Direct-Buried Conduit:

- 1. Excavate trench bottom to provide firm and uniform support for conduit. Prepare trench bottom as specified in Division 31 Section "Earth Moving" for pipe less than 6 inches in nominal diameter.
- 2. Install backfill as specified in Division 31 Section "Earth Moving."
- 3. After installing conduit, backfill and compact. Start at tie-in point, and work toward end of conduit run, leaving conduit at end of run free to move with expansion and contraction as temperature changes during this process. Firmly hand tamp backfill around conduit to provide maximum supporting strength. After placing controlled backfill to within 12 inches of finished grade, make final conduit connection at end of run and complete backfilling with normal compaction as specified in Division 31 Section "Earth Moving."
- 4. Install manufactured duct elbows for stub-ups at poles and equipment and at building entrances through the floor, unless otherwise indicated. Encase elbows for stub-up ducts throughout the length of the elbow.
- 5. Install manufactured rigid steel conduit elbows for stub-ups at poles and equipment and at building entrances through the floor.
 - a. Couple steel conduits to ducts with adapters designed for this purpose, and encase coupling with 3 inches of concrete.
 - b. For stub-ups at equipment mounted on outdoor concrete bases, extend steel conduit horizontally a minimum of 60 inches from edge of equipment pad or foundation. Install insulated grounding bushings on terminations at equipment.

3.04 INSTALLATION OF UNDERGROUND HANDHOLES AND BOXES

- A. Install handholes and boxes level and plumb and with orientation and depth coordinated with connecting conduits to minimize bends and deflections required for proper entrances.
- B. Unless otherwise indicated, support units on a level bed of crushed stone or gravel, graded from 1/2-inch sieve to No. 4 sieve and compacted to same density as adjacent undisturbed earth.
- C. Elevation: In paved areas, set so cover surface will be flush with finished grade. Set covers of other enclosures 1 inch above finished grade.
- D. Field-cut openings for conduits according to enclosure manufacturer's written instructions. Cut wall of enclosure with a tool designed for material to be cut. Size holes for terminating fittings to be used, and seal around penetrations after fittings are installed.

3.05 PROTECTION

- A. Provide final protection and maintain conditions that ensure coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.
 - 1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
 - 2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

END OF SECTION

Section 26 05 53 Identification for Electrical Systems

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Identification for raceways.
 - 2. Identification of power and control cables.
 - 3. Identification for conductors.
 - 4. Underground-line warning tape.
 - 5. Warning labels and signs.
 - 6. Instruction signs.
 - 7. Equipment identification labels.
 - 8. Miscellaneous identification products.

1.03 SUBMITTALS

- A. Product Data: For each electrical identification product indicated.
- B. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions, and graphic features of identification products.
- C. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.04 QUALITY ASSURANCE

- A. Comply with ANSI A13.1.
- B. Comply with NFPA 70.
- C. Comply with 29 CFR 1910.144 and 29 CFR 1910.145.
- D. Comply with ANSI Z535.4 for safety signs and labels.
- E. Adhesive-attached labeling materials, including label stocks, laminating adhesives, and inks used by label printers, shall comply with UL 969.

1.05 COORDINATION

- A. Coordinate identification names, abbreviations, colors, and other features with requirements in other Sections requiring identification applications, Drawings, Shop Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual; and with those required by codes, standards, and 29 CFR 1910.145. Use consistent designations throughout Project.
- B. Coordinate installation of identifying devices with completion of covering and painting of surfaces where devices are to be applied.
- C. Coordinate installation of identifying devices with location of access panels and doors.
- D. Install identifying devices before installing acoustical ceilings and similar concealment.

PART 2 - PRODUCTS

2.01 POWER AND CONTROL CABLE IDENTIFICATION MATERIALS

- A. Comply with ANSI A13.1 for minimum size of letters for legend and for minimum length of color field for each raceway and cable size.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.

2.02 CONDUCTOR IDENTIFICATION MATERIALS

- A. Color-Coding Conductor Tape: Colored, self-adhesive vinyl tape, not less than 3 mils thick by 1 to 2 inches wide.
- B. Self-Adhesive Vinyl Labels: Preprinted, flexible label laminated with a clear, weather- and chemical-resistant coating and matching wraparound adhesive tape for securing ends of legend label.
- C. Marker Tapes: Vinyl or vinyl-cloth, self-adhesive wraparound type, with circuit identification legend machine printed by thermal transfer or equivalent process.

2.03 UNDERGROUND-LINE WARNING TAPE

- A. Tape:
 - 1. Recommended by manufacturer for the method of installation and suitable to identify and locate underground electrical and communications utility lines.
 - 2. Printing on tape shall be permanent and shall not be damaged by burial operations.
 - 3. Tape material and ink shall be chemically inert, and not subject to degrading when exposed to acids, alkalis, and other destructive substances commonly found in soils.
- B. Color and Printing:
 - 1. Comply with ANSI Z535.1 through ANSI Z535.5.

2. Inscriptions for Red-Colored Tapes: ELECTRIC LINE, HIGH VOLTAGE.
3. Inscriptions for Orange-Colored Tapes: TELEPHONE CABLE, COMMUNICATIONS CABLE.

2.04 EQUIPMENT IDENTIFICATION LABELS

- A. Engraved, Laminated Acrylic or Melamine Label: Punched or drilled for screw mounting. White letters on a dark-gray background. Minimum letter height shall be 3/8 inch.

2.05 MISCELLANEOUS IDENTIFICATION PRODUCTS

- A. Fasteners for Labels and Signs: Self-tapping, stainless-steel screws or stainless-steel machine screws with nuts and flat and lock washers.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Verify identity of each item before installing identification products.
- B. Location: Install identification materials and devices at locations for most convenient viewing without interference with operation and maintenance of equipment.
- C. Apply identification devices to surfaces that require finish after completing finish work.
- D. Attach signs and plastic labels that are not self-adhesive type with mechanical fasteners appropriate to the location and substrate.
- E. Underground-Line Warning Tape: During backfilling of trenches install continuous underground-line warning tape directly above line at 6 to 8 inches below finished grade. Use multiple tapes where width of multiple lines installed in a common trench exceeds 16 inches overall.
- F. Painted Identification: Comply with requirements in Division 09 painting Sections for surface preparation and paint application.
- G. Power-Circuit Conductor Identification, 600 V or Less: For conductors in vaults, pull and junction boxes, manholes, and handholes, use color-coding conductor tape to identify the phase.
 1. Color-Coding for Phase Identification, 600 V or Less: Use colors listed below for ungrounded service, feeder and branch-circuit conductors.
 - a. Color shall be factory applied, or field applied for sizes larger than No. 8 AWG.
 - b. Colors for 240/120-V Circuits:
 - 1) Phase A: Black.
 - 2) Phase B: (High Leg) Orange.
 - 3) Phase C: Blue.
 - c. Field-Applied, Color-Coding Conductor Tape: Apply in half-lapped turns for a minimum distance of 6 inches from terminal points and in boxes where splices or taps

are made. Apply last two turns of tape with no tension to prevent possible unwinding. Locate bands to avoid obscuring factory cable markings.

- H. Install instructional sign, including the color code for grounded and ungrounded conductors, using adhesive-film-type labels.
- I. Auxiliary Electrical Systems Conductor Identification: Identify field-installed alarm, control, and signal connections.
 - 1. Identify conductors, cables, and terminals in enclosures and at junctions, terminals, and pull points. Identify by system and circuit designation.
 - 2. Use system of marker tape designations that is uniform and consistent with system used by manufacturer for factory-installed connections.
 - 3. Coordinate identification with Project Drawings, manufacturer's wiring diagrams, and the Operation and Maintenance Manual.
- J. Locations of Underground Lines: Identify with underground-line warning tape for power, lighting, communication, and control wiring.
 - 1. Install underground-line warning tape for both direct-buried cables and cables in raceway.
- K. Operating Instruction Signs: Install instruction signs to facilitate proper operation and maintenance of electrical systems and items to which they connect. Install instruction signs with approved legend where instructions are needed for system or equipment operation.
- L. Emergency Operating Instruction Signs: Install instruction signs with white legend on a red background with minimum 3/8-inch high letters for emergency instructions at equipment used for power transfer.
- M. Equipment Identification Labels: On each unit of equipment, install unique designation label that is consistent with wiring diagrams, schedules, and the Operation and Maintenance Manual. Apply labels to disconnect switches and protection equipment, central or master units, control panels, control stations, terminal cabinets, and racks of each system. Systems include power, lighting, control, communication, signal, monitoring, and alarm systems unless equipment is provided with its own identification.
 - 1. Labeling Instructions:
 - a. Outdoor Equipment: Engraved, laminated acrylic, 4 inches high.
 - b. Unless provided with self-adhesive means of attachment, fasten labels with appropriate mechanical fasteners that do not change the NEMA or NRTL rating of the enclosure.
 - 2. Equipment to Be Labeled:
 - a. Panelboards: Typewritten directory of circuits in the location provided by panelboard manufacturer. Panelboard identification shall be engraved or laminated acrylic.
 - b. Enclosures and electrical cabinets.
 - c. Emergency system boxes and enclosures.
 - d. Enclosed switches.
 - e. Enclosed circuit breakers.
 - f. Enclosed controllers.
 - g. Power transfer equipment.

END OF SECTION

Section 26 24 16 Panelboards

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Lighting and appliance branch-circuit panelboards.

1.03 DEFINITIONS

- A. SVR: Suppressed voltage rating.
- B. TVSS: Transient voltage surge suppressor.

1.04 SUBMITTALS

- A. Product Data: For each type of panelboard, switching and overcurrent protective device, transient voltage suppression device, accessory, and component indicated. Include dimensions and manufacturers' technical data on features, performance, electrical characteristics, ratings, and finishes.
- B. Shop Drawings: For each panelboard and related equipment.
 - 1. Include dimensioned plans, elevations, sections, and details. Show tabulations of installed devices, equipment features, and ratings.
 - 2. Detail enclosure types and details.
 - 3. Detail bus configuration, current, and voltage ratings.
 - 4. Short-circuit current rating of panelboards and overcurrent protective devices.
 - 5. Include evidence of NRTL listing for series rating of installed devices.
 - 6. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices and auxiliary components.
 - 7. Include wiring diagrams for power, signal, and control wiring.
 - 8. Include time-current coordination curves for each type and rating of overcurrent protective device included in panelboards. Submit on translucent log-log graft paper; include selectable ranges for each type of overcurrent protective device.
- C. Qualification Data: For qualified testing agency.
- D. Panelboard Schedules: For installation in panelboards. Submit final versions after load balancing.

- E. Operation and Maintenance Data: For panelboards and components to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:

1. Manufacturer's written instructions for testing and adjusting overcurrent protective devices.
2. Time-current curves, including selectable ranges for each type of overcurrent protective device that allows adjustments.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain panelboards, overcurrent protective devices, components, and accessories from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for panelboards including clearances between panelboards and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NEMA PB 1.
- F. Comply with NFPA 70.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Handle and prepare panelboards for installation according to NEMA PB 1.

1.07 COORDINATION

- A. Coordinate layout and installation of panelboards and components with other construction that penetrates walls or is supported by them, including electrical and other types of equipment, raceways, piping, encumbrances to workspace clearance requirements, and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.
- B. Coordinate sizes and locations of concrete bases with actual equipment provided. Cast anchor-bolt inserts into bases. Concrete, reinforcement, and formwork requirements are specified in Division 03.

1.08 EXTRA MATERIALS

- A. Furnish extra materials that match products installed and that are packaged with protective covering for storage and identified with labels describing contents.

1. Keys: Two spares for each type of panelboard cabinet lock.
2. Circuit Breakers Including GFCI and Ground Fault Equipment Protection (GFEP) Types: Three spares for each panelboard.

PART 2 - PRODUCTS

2.01 GENERAL REQUIREMENTS FOR PANELBOARDS

- A. Fabricate and test panelboards according to IEEE 344 to withstand seismic forces defined in Division 26 Section "Vibration and Seismic Controls for Electrical Systems."
- B. Enclosures: Surface-mounted cabinets.
 1. Rated for environmental conditions at installed location.
 - a. Indoor Dry and Clean Locations: NEMA 250, Type 1.
 - b. Outdoor Locations: NEMA 250, Type 3R.
 - c. Other Wet or Damp Indoor Locations: NEMA 250, Type 4.
 2. Front: Secured to box with concealed trim clamps. For surface-mounted fronts, match box dimensions; for flush-mounted fronts, overlap box.
 3. Hinged Front Cover: Entire front trim hinged to box and with standard door within hinged trim cover.
 4. Skirt for Surface-Mounted Panelboards: Same gage and finish as panelboard front with flanges for attachment to panelboard, wall, and ceiling or floor.
 5. Gutter Extension and Barrier: Same gage and finish as panelboard enclosure; integral with enclosure body. Arrange to isolate individual panel sections.
 6. Finishes:
 - a. Panels and Trim: Steel, factory finished immediately after cleaning and pretreating with manufacturer's standard two-coat, baked-on finish consisting of prime coat and thermosetting topcoat.
 - b. Back Boxes: Galvanized steel.
 - c. Fungus Proofing: Permanent fungicidal treatment for overcurrent protective devices and other components.
 7. Directory Card: Inside panelboard door, mounted in transparent card holder with type-written schedule of all installed circuit breakers.
- C. Phase, Neutral, and Ground Buses:
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Equipment Ground Bus: Adequate for feeder and branch-circuit equipment grounding conductors; bonded to box.
- D. Conductor Connectors: Suitable for use with conductor material and sizes.
 1. Material: Hard-drawn copper, 98 percent conductivity.
 2. Main and Neutral Lugs: Mechanical type.
 3. Ground Lugs and Bus-Configured Terminators: [Mechanical type.

- E. Service Equipment Label: NRTL labeled for use as service equipment for panelboards or load centers with one or more main service disconnecting and overcurrent protective devices.
- F. Future Devices: Mounting brackets, bus connections, filler plates, and necessary appurtenances required for future installation of devices.
- G. Panelboard Short-Circuit Current Rating: Rated for series-connected system with integral or remote upstream overcurrent protective devices and labeled by an NRTL. Include size and type of allowable upstream and branch devices, listed and labeled for series-connected short-circuit rating by an NRTL.
- H. Panelboard Short-Circuit Current Rating: Fully rated to interrupt symmetrical short-circuit current available at terminals.

2.02 LIGHTING AND APPLIANCE BRANCH-CIRCUIT PANELBOARDS

- A. Panelboards: NEMA PB 1, lighting and appliance branch-circuit type.
- B. Mains: lugs only.
- C. Branch Overcurrent Protective Devices: Bolt-on circuit breakers, replaceable without disturbing adjacent units.
- D. Doors: Concealed hinges; secured with flush latch with tumbler lock; keyed alike.

2.03 DISCONNECTING AND OVERCURRENT PROTECTIVE DEVICES

- A. Molded-Case Circuit Breaker (MCCB): Comply with UL 489, with interrupting capacity to meet available fault currents.
 - 1. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads, and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
 - 2. Adjustable Instantaneous-Trip Circuit Breakers: Magnetic trip element with front-mounted, field-adjustable trip setting.
 - 3. Current-Limiting Circuit Breakers: Frame sizes 400 A and smaller; let-through ratings less than NEMA FU 1, RK-5.
 - 4. GFCI Circuit Breakers: Single- and two-pole configurations with Class A ground-fault protection (6-mA trip).
 - 5. Molded-Case Circuit-Breaker (MCCB) Features and Accessories:
 - a. Standard frame sizes, trip ratings, and number of poles.
 - b. Lugs: Mechanical style, suitable for number, size, trip ratings, and conductor materials.
 - c. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge (HID) lighting circuits.
 - d. Ground-Fault Protection: Integrally mounted relay and trip unit with adjustable pickup and time-delay settings, push-to-test feature, and ground-fault indicator.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Receive, inspect, handle, and store panelboards according to NEMA PB 1.1.
- B. Examine panelboards before installation. Reject panelboards that are damaged or rusted or have been subjected to water saturation.
- C. Examine elements and surfaces to receive panelboards for compliance with installation tolerances and other conditions affecting performance of the Work.
- D. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install panelboards and accessories according to NEMA PB 1.1.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from panelboards.
- C. Mount panelboard cabinet plumb and rigid without distortion of box. Mount recessed panelboards with fronts uniformly flush with wall finish and mating with back box.
- D. Install overcurrent protective devices and controllers not already factory installed.
 - 1. Set field-adjustable, circuit-breaker trip ranges.
- E. Install filler plates in unused spaces.
- F. Arrange conductors in gutters into groups and bundle and wrap with wire ties after completing load balancing.
- G. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs complying with Division 26 Section "Identification for Electrical Systems."
- B. Create a directory to indicate installed circuit loads after balancing panelboard loads; incorporate Owner's final room designations. Obtain approval before installing. Use a computer or typewriter to create directory; handwritten directories are not acceptable.
- C. Panelboard Nameplates: Label each panelboard with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."
- D. Device Nameplates: Label each branch circuit device in distribution panelboards with a nameplate complying with requirements for identification specified in Division 26 Section "Identification for Electrical Systems."

3.04 FIELD QUALITY CONTROL

A. Acceptance Testing Preparation:

1. Test insulation resistance for each panelboard bus, component, connecting supply, feeder, and control circuit.
2. Test continuity of each circuit.

B. Tests and Inspections:

1. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
2. Correct malfunctioning units on-site, where possible, and retest to demonstrate compliance; otherwise, replace with new units and retest.

C. Panelboards will be considered defective if they do not pass tests and inspections.

3.05 ADJUSTING

A. Adjust moving parts and operable component to function smoothly, and lubricate as recommended by manufacturer.

B. Load Balancing: After Substantial Completion, but not more than 60 days after Final Acceptance, measure load balancing and make circuit changes.

1. Measure as directed during period of normal system loading.
2. Perform load-balancing circuit changes outside normal occupancy/working schedule of the facility and at time directed. Avoid disrupting critical 24-hour services such as fax machines and on-line data processing, computing, transmitting, and receiving equipment.
3. After circuit changes, recheck loads during normal load period. Record all load readings before and after changes and submit test records.
4. Tolerance: Difference exceeding 20 percent between phase loads, within a panelboard, is not acceptable. Rebalance and recheck as necessary to meet this minimum requirement.

END OF SECTION

Section 26 28 16 Enclosed Switches and Circuit Breakers

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. Section Includes:
 - 1. Nonfusible switches.
 - 2. Molded-case circuit breakers (MCCBs).

1.03 DEFINITIONS

- A. NC: Normally closed.
- B. NO: Normally open.
- C. SPDT: Single pole, double throw.

1.04 SUBMITTALS

- A. Product Data: For each type of enclosed switch, circuit breaker, accessory, and component indicated. Include dimensioned elevations, sections, weights, and manufacturers' technical data on features, performance, electrical characteristics, ratings, accessories, and finishes.
 - 1. Enclosure types and details for types other than NEMA 250, Type 1.
 - 2. Current and voltage ratings.
 - 3. Short-circuit current ratings (interrupting and withstand, as appropriate).
 - 4. Include evidence of NRTL listing for series rating of installed devices.
 - 5. Detail features, characteristics, ratings, and factory settings of individual overcurrent protective devices, accessories, and auxiliary components.
- B. Operation and Maintenance Data: For enclosed switches and circuit breakers to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Manufacturer's written instructions for testing and adjusting enclosed switches and circuit breakers.
 - 2. Time-current coordination curves (average melt) for each type and rating of overcurrent protective device; include selectable ranges for each type of overcurrent protective device.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications: Member company of NETA or an NRTL.
 - 1. Testing Agency's Field Supervisor: Currently certified by NETA to supervise on-site testing.
- B. Source Limitations: Obtain enclosed switches and circuit breakers, overcurrent protective devices, components, and accessories, within same product category, from single source from single manufacturer.
- C. Product Selection for Restricted Space: Drawings indicate maximum dimensions for enclosed switches and circuit breakers, including clearances between enclosures, and adjacent surfaces and other items. Comply with indicated maximum dimensions.
- D. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
- E. Comply with NFPA 70.

1.06 PROJECT CONDITIONS

- A. Environmental Limitations: Rate equipment for continuous operation under the following conditions unless otherwise indicated:
 - 1. Ambient Temperature: Not less than minus 22 deg F and not exceeding 104 deg F.
 - 2. Altitude: Not exceeding 6600 feet.
- B. Interruption of Existing Electric Service: Do not interrupt electric service to facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary electric service according to requirements indicated:
 - 1. Notify Owner no fewer than seven days in advance of proposed interruption of electric service.
 - 2. Indicate method of providing temporary electric service.
 - 3. Do not proceed with interruption of electric service without Owner's written permission.
 - 4. Comply with NFPA 70E.

1.07 COORDINATION

- A. Coordinate layout and installation of switches, circuit breakers, and components with equipment served and adjacent surfaces. Maintain required workspace clearances and required clearances for equipment access doors and panels.

PART 2 - PRODUCTS

2.01 NONFUSIBLE SWITCHES

- A. Type HD, Heavy Duty, Single Throw, 600 V ac, 1200 A and Smaller: UL 98 and NEMA KS 1, horsepower rated, lockable handle with capability to accept three padlocks, and interlocked with cover in closed position.
- B. Accessories:
 - 1. Equipment Ground Kit: Internally mounted and labeled for copper and aluminum ground conductors.
 - 2. Neutral Kit: Internally mounted; insulated, capable of being grounded and bonded; labeled for copper and aluminum neutral conductors.
 - 3. Lugs: Mechanical type, suitable for number, size, and conductor material.

2.02 MOLDED-CASE CIRCUIT BREAKERS

- A. General Requirements: Comply with UL 489, NEMA AB 1, and NEMA AB 3, with interrupting capacity to comply with available fault currents.
- B. Thermal-Magnetic Circuit Breakers: Inverse time-current element for low-level overloads and instantaneous magnetic trip element for short circuits. Adjustable magnetic trip setting for circuit-breaker frame sizes 250 A and larger.
- C. Features and Accessories:
 - 1. Standard frame sizes, trip ratings, and number of poles.
 - 2. Lugs: Mechanical type, suitable for number, size, trip ratings, and conductor material.
 - 3. Application Listing: Appropriate for application; Type SWD for switching fluorescent lighting loads; Type HID for feeding fluorescent and high-intensity discharge lighting circuits.

2.03 ENCLOSURES

- A. Enclosed Switches and Circuit Breakers: NEMA AB 1, NEMA KS 1, NEMA 250, and UL 50, to comply with environmental conditions at installed location.
 - 1. Indoor, Dry and Clean Locations: NEMA 250, Type 1.
 - 2. Outdoor Locations: NEMA 250, Type 3R.

PART 3 - EXECUTION

3.01 EXAMINATION

- A. Examine elements and surfaces to receive enclosed switches and circuit breakers for compliance with installation tolerances and other conditions affecting performance of the Work.

- B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.02 INSTALLATION

- A. Install individual wall-mounted switches and circuit breakers with tops at uniform height unless otherwise indicated.
- B. Temporary Lifting Provisions: Remove temporary lifting eyes, channels, and brackets and temporary blocking of moving parts from enclosures and components.
- C. Comply with NECA 1.

3.03 IDENTIFICATION

- A. Comply with requirements in Division 26 Section "Identification for Electrical Systems."
 - 1. Identify field-installed conductors, interconnecting wiring, and components; provide warning signs.
 - 2. Label each enclosure with engraved metal or laminated-plastic nameplate.

3.04 FIELD QUALITY CONTROL

- A. Testing Agency: Engage a qualified testing agency to perform tests and inspections.
- B. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect, test, and adjust components, assemblies, and equipment installations, including connections.
- C. Perform tests and inspections.
 - 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installations, including connections, and to assist in testing.
- D. Acceptance Testing Preparation:
 - 1. Test insulation resistance for each enclosed switch and circuit breaker, component, connecting supply, feeder, and control circuit.
 - 2. Test continuity of each circuit.
- E. Enclosed switches and circuit breakers will be considered defective if they do not pass tests and inspections.
- F. Prepare test and inspection reports, including a certified report that identifies enclosed switches and circuit breakers and that describes scanning results. Include notation of deficiencies detected, remedial action taken, and observations after remedial action.

3.05 ADJUSTING

- A. Adjust moving parts and operable components to function smoothly, and lubricate as recommended by manufacturer.

END OF SECTION

Section 26 36 00 Transfer Switches

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SUMMARY

- A. This Section includes transfer switches rated 600 V and less, including the following:
 - 1. Nonautomatic transfer switches.

1.03 SUBMITTALS

- A. Product Data: For each type of product indicated. Include rated capacities, weights, operating characteristics, furnished specialties, and accessories.
- B. Shop Drawings: Dimensioned plans, elevations, sections, and details showing minimum clearances, conductor entry provisions, gutter space, installed features and devices, and material lists for each switch specified.
- C. Qualification Data: For manufacturer.
- D. Field quality-control test reports.
- E. Operation and Maintenance Data: For each type of product to include in emergency, operation, and maintenance manuals. In addition to items specified in Division 01 Section "Operation and Maintenance Data," include the following:
 - 1. Features and operating sequences, both automatic and manual.
 - 2. List of all factory settings of relays; provide relay-setting and calibration instructions, including software, where applicable.

1.04 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Maintain a service center capable of providing training, parts, and emergency maintenance repairs within a response period of less than eight hours from time of notification.
- B. Testing Agency Qualifications: An independent agency, with the experience and capability to conduct the testing indicated, that is a member company of the InterNational Electrical Testing Association, or is a nationally recognized testing laboratory (NRTL) as defined by OSHA in 29 CFR 1910.7, and that is acceptable to authorities having jurisdiction.

- C. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.
- D. Comply with NEMA ICS 1.
- E. Comply with NFPA 70.
- F. Comply with UL 1008 unless requirements of these Specifications are stricter.

PART 2 - PRODUCTS

2.01 GENERAL TRANSFER-SWITCH PRODUCT REQUIREMENTS

- A. Indicated Current Ratings: Apply as defined in UL 1008 for continuous loading and total system transfer, including tungsten filament lamp loads not exceeding 30 percent of switch ampere rating, unless otherwise indicated.
- B. Tested Fault-Current Closing and Withstand Ratings: Adequate for duty imposed by protective devices at installation locations in Project under the fault conditions indicated, based on testing according to UL 1008.
 - 1. Where transfer switch includes internal fault-current protection, rating of switch and trip unit combination shall exceed indicated fault-current value at installation location.
- C. Resistance to Damage by Voltage Transients: Components shall meet or exceed voltage-surge withstand capability requirements when tested according to IEEE C62.41. Components shall meet or exceed voltage-impulse withstand test of NEMA ICS 1.
- D. Switch Characteristics: Designed for continuous-duty repetitive transfer of full-rated current between active power sources.
 - 1. Limitation: Switches using molded-case switches or circuit breakers or insulated-case circuit-breaker components are not acceptable.
 - 2. Switch Action: Double throw; mechanically held in both directions.
 - 3. Contacts: Silver composition or silver alloy for load-current switching. Conventional automatic transfer-switch units, rated 225 A and higher, shall have separate arcing contacts.
- E. Neutral Terminal: Solid and fully rated, unless otherwise indicated.
- F. Enclosures: General-purpose NEMA 250, Type 1, complying with NEMA ICS 6 and UL 508, unless otherwise indicated.

2.02 NONAUTOMATIC TRANSFER SWITCHES

- A. Operation: Manually actuated. Switch shall be capable of transferring load in either direction with either or both sources energized.
- B. Double-Throw Switching Arrangement: Incapable of pauses or intermediate position stops during switching sequence.

C. Nonautomatic Transfer-Switch Accessories:

1. Unassigned Auxiliary Contacts: One set of normally closed contacts for each switch position, rated 10 A at 240-V ac.

PART 3 - EXECUTION

3.01 INSTALLATION

- A. Annunciator and Control Panel Mounting: Flush in wall, unless otherwise indicated.
- B. Identify components according to Division 26 Section "Identification for Electrical Systems."

3.02 CONNECTIONS

- A. Wiring to Remote Components: Match type and number of cables and conductors to control and communication requirements of transfer switches as recommended by manufacturer. Increase raceway sizes at no additional cost to Owner if necessary to accommodate required wiring.
- B. Ground equipment according to Division 26 Section "Grounding and Bonding for Electrical Systems."
- C. Connect wiring according to Division 26 Section "Low-Voltage Electrical Power Conductors and Cables."

3.03 FIELD QUALITY CONTROL

- A. Perform tests and inspections and prepare test reports.
 1. Manufacturer's Field Service: Engage a factory-authorized service representative to inspect components, assemblies, and equipment installation, including connections, and to assist in testing.
 2. After installing equipment and after electrical circuitry has been energized, test for compliance with requirements.
 3. Perform each visual and mechanical inspection and electrical test stated in NETA Acceptance Testing Specification. Certify compliance with test parameters.
 4. Measure insulation resistance phase-to-phase and phase-to-ground with insulation-resistance tester. Include external annunciation and control circuits. Use test voltages and procedure recommended by manufacturer. Comply with manufacturer's specified minimum resistance.
 - a. Check for electrical continuity of circuits and for short circuits.
 - b. Inspect for physical damage, proper installation and connection, and integrity of barriers, covers, and safety features.
 - c. Verify that manual transfer warnings are properly placed.
 - d. Perform manual transfer operation.

END OF SECTION

Section 33 09 30

Instrumentation and Control for Sanitary Sewage Pump Station

PART 1 - General

1.01 Summary

This Section describes the control system and its components for a simplex pumping station with a backup pumping unit. The control system is a simple on-off pump control using level switches. Remote notification of alarm conditions shall be provided with a cellular notification system. This section includes the main enclosure and individual control units.

1.02 Price and Payment Procedures

The work described in this section shall be paid for under the bid item for electric service and controls.

1.03 Submittals

- A. Product Information shall be submitted for each product specified.
- B. Shop drawings shall be provided for the control system and the cellular pump station monitoring system.
- C. 911 Address Sign layout.

1.04 Closeout Submittals – As-built drawings shall be provided incorporating any changes made in the field

1.05 Quality Assurance

A. Manufacturer:

- 1. Everything described in this section shall be provided as a single assembly ready for mounting and connection of field connections including incoming power, communications wiring, control wiring and power for the pumps.
- 2. The manufacturer/integrator of the unit shall furnish proof of a minimum of ten (10) installations and five (5) years of continuous operation.
- 3. The manufacturer/integrator shall have representation in NYS for service calls. Emergency service shall be provided with response time for contact by phone within 1 hour of first request and, if needed, personnel shall be on-site within 6 hours.

B. The final product and all materials used in the construction or fabrication of the product shall conform to all applicable codes: Putnam County/NYS Building Code, NEC, OSHA, ASTM, etc.

C. Products shall be clearly marked with Manufacturer's name or, trade name. Other identifying marks such as serial no., model no, etc shall also be on the unit. All markings shall be cast,

welded, or, otherwise permanently fixed to the product.

- D. Defects or damage shall be repaired or replaced with material that meets specification or the approval of the engineer at no additional cost to the Owner..

1.06 Warranty

- A. All products will have a minimum of a one-year warranty. Repairs made due to defects of workmanship and/or materials shall be made at no cost to the owner including labor and materials. Damage due to natural causes such as lightning , natural disaster, or, accident is not considered warranty work.

PART 2 - **Products.**

2.01 Enclosure

- A. Acceptable Manufacturers: Any manufacturer that is in the business of making control system enclosures and has a product that can meet this specification.
- B. Materials, Components and finishes.
1. The over all panel shall meet NEMA 4 enclosure standards. Panels interior to the overall enclosure shall be NEMA 1
 2. The overall cabinet shall be a free standing unit with all hardware necessary to attach to a concrete base. Interior panels shall be wall mounted on to the backing plate of the overall cabinet.
 3. The panels shall be a 14 ga cold rolled steel; painted with a rust inhibiting primer followed by 2-coats of industrial grade enamel, gray on the exterior and white on the interior suitable for continuous exterior exposure.
 4. The panel shall be provided with a solid base riser. The base riser shall be separated from the concrete base with a bituminous or neoprene gasket.
- C. The overall cabinet shall be generally the size indicated on the plan. The final size must be able to contain all the equipment necessary for power distribution, pump control and monitoring and part storage. Significant increases or decreases in the size shall be reviewed with the Engineer. Interior panels shall be the size necessary to house the control equipment.
- D. Accessories
1. The Overall cabinet will be provided with an internal light that operates on a door switch; a side mounted filtered ventilation fan that operates to cool the cabinet, a panel heater to minimize condensation and a desiccant sponge to minimize moisture in each of the interior enclosures.
 2. The cabinet will have a switch on all operable leafs of the cabinet to indicate that the cabinet has been opened.
 3. The cabinet latch shall have a keyed lock to gain access.

2.02 Storage Cabinet

A. Unit description:

1. The Storage Cabinet shall be a wall mounted metal unit with approximate dimensions of 18w x 12" d x 26" h. Dimension can vary to fit into free space available.
2. At least 1 moveable shelf shall be provided. Each shelf shall be capable of supporting 85lbs.
3. A single door shall be latched with a friction catch or lever handle.

- B. The unit shall be by Global Industrial, Sandusky Lee or other manufacturer meeting these specifications.

2.03 Power Distribution.

- A. Power Distribution shall meet the requirements identified in the electrical specifications. All circuit breakers shall be lock-out/tag-out compliant.
- B. Panel Wiring: All sub panel wiring shall be run in plastic wire duct sized with 50% spare space, AC and DC wiring shall be run in separate wire ducts.

All field terminations shall be made on compression type terminal blocks labeled according to wire number, separate terminal strips shall be provided for AC and DC signals. A minimum of 5% spare terminals shall be provided.

Wiring to door mounted components shall be neatly bundled wiring harnesses protected by plastic spiral wire wrap when crossing door hinge. Wiring harnesses shall have adequate stress loops and be fastened at both sides of hinge crossing.

All wiring shall be wire numbered at both ends with plastic Brady type labels.

Compression type terminal blocks shall be provided for all field connections, wiring field equipment directly to PLC I/O bases or other panel components is not acceptable. Terminal blocks shall have the following electrical ratings as a minimum:

Two Level Terminal Blocks

- i. Rated Voltage: 300V AC/DC
- ii. Rated Current: 20 Amp
- iii. Wire Size Range: 30-12 AWG

Three Level Terminal Blocks

- i. Rated Voltage: 300V AC/DC
- ii. Rated Current: 10 Amp
- iii. Wire Size Range: 26-14 AWG

C. Power Supply:

All power supplies shall be sized for an additional 50% spare ampacity over expected load. Each power supply shall include an AC input fuse and independent output fuses for each device requiring DC power.

DC power supply: a direct current power supply shall be provided to power equipment requiring a low voltage power if any is present in the panel.

The panel shall have an uninterruptible power supply to protect the components from high and low surges, high and low voltage and temporary interruptions of power.

D. .Short Circuit Protection

AC power fuses shall be provided as required for over current protection of individual AC powered panel components. Single circuit fusible terminal blocks with neon blown fuse indicators suitable for use with ¼" x 1 ¼" glass fuses shall be provided for each circuit requiring fuse protection. Fusible terminal strips shall have a working voltage rating of 100 to 300VAC, and have a current rating of 12 Amps.

DC power fuses shall be provided as required for over current protection of individual DC powered panel components. Single circuit fusible terminal blocks with LED blown fuse indicators suitable for use with ¼" x 1 ¼" glass fuses shall be provided for each circuit requiring fuse protection. Fusible terminal strips shall have a working voltage rating of 10 to 57V AC/DC, and have a current rating of 12 Amps.

The 120VAC supply shall be protected by a miniature branch rated circuit breaker with an interruptive capacity of 10K amperes at 240VAC.

2.04 Control System

A. Description of Operation

1. The control system shall include all relays, starters, alternators and protection devices needed to operate a simplex pump station with 100% reserve capacity pump and interface with a pump station monitor for remote notification of alarm and pump operation monitoring.
2. Alternation – The two pumps will alternate operation after each pump-on/off cycle. The panel will have a selector switch to allow automatic alternation or no alternation with either pump 1 or pump 2 in lead operation.
3. The pumping cycles will be controlled by four float switches in the wet well. Each float switch will have the following function from the lowest float to the highest:
 - a) First Float – Redundant all pumps off float and low level alarm.
 - b) Second Float – All pumps off
 - c) Third Float – Pump on.
 - d) Fourth Float – High level alarm and Reserve Pump on.
4. Alarm condition – The panel will interface with pump station monitor and user interface with the following alarm conditions:
 - a) High level alarm will be monitored by a dry relay type C contact.
 - b) Low level alarm will be monitored by a dry relay type C contact with an adjustable time on-delay.
 - c) Pump Fail for each pump will be triggered by motor start over load trip, phase loss,

- high winding temp, moisture in pump or no start after call-to run with an adjustable on-delay timer.
 - d) Incoming Power status – power outage.
 - e) Door open alert – The door switches will be monitored by a dry type C relay with an adjustable delay timer.
 - f) Note that the pump station monitor has other alarm and monitoring functions beyond those listed here.
 - g) Power outage shall not trigger a false alarm.
5. Phase loss protection will be provided independently for each pump
6. Incoming power will be monitored and have the following protection:
- a) Overvoltage
 - b) Undervoltage
 - c) Surge
 - d) Lightning on all three phases
 - e) An Uninterruptible Power supply/power filter will be provided for the control circuit only.
7. User interface will be provided on the face of the interior control panel
- a) Each pump will be provided with a Hand-Off-Auto selector switch that is lock-out tag-out compliant.
 - b) Pump Moisture/temperature Alarm – A light will be provided for each pump to indicate moisture detection in the pump cavity or a high winding temperature.
 - c) Float activation indicators – Lights shall indicate which floats are in an active state (i.e. – calling for action).
 - d) Each pump will be provided with an elapsed time meter and a counter to indicate pump starts.
 - e) Alternation selector switch: Auto, 1-2, 2-1
 - f) Disarm push button switch and light for the door open alarm.
 - g) A Switch which can silence the audible alarm temporarily or disable its operation.
 - h) A light test button.
8. The following alarms will operate on high water condition or unacknowledged door open. (no operation when utility power is out) They will be mounted on the exterior of the control cabinet on its side:

- a) Alarm beacon
- b) Audible Alarm.

B. Description of components

1. Motor Starter –

- a) Any manufacturer that meets the requirement stated in this specification will be considered under the Shop Drawing, Product Data and Sample Submittal procedures. Acceptable manufacturers include Furnas, SquareD, General Electric, Benshaw; or equal as approved by the Engineer.
- b) . Starters shall be NEMA type 1, General Purpose full voltage starter.
- c) The starter shall be sized to accommodate the motor HP rating specified elsewhere
- d) The coil operating voltage shall be 120V, 60 Hz.

2. Motor Overload Protection

- a) Standard Thermal overload protection that can be set by a dial and .

3. Phase loss

- a) The phase loss will be provided for each motor independently.
- b) Phase loss devices will be capable of working on a 240V 3-phase circuit with a high voltage leg.

4. Surge protection

- a) Surge protection from voltage spikes in the power feed to the control circuit will be provided by separate replaceable units.
- b) This may be included as part of the UPS device.

5. Uninterruptible Power supply

- a) The UPS device will filter the power coming to the control systems.
- b) The selected unit shall be intended for use in control panels.
- c) The high level alarm shall operate for at least 24-hrs after normal line voltage has been lost.

6. Mechanical Float switches

- a) Mechanical float switch shall have a snap action switch that uses no mercury.
- b) The switch shall be SPST, UL listed for sewage operate with an intrinsically safe barrier for a Class 1 Division 1, Group D Environment.

- c) The switches shall include a cord external weight.

7. Hour meters

- a) The hour meters will be provided on all pump circuits and be used to record the elapsed time for pump operation.
- b) The hour meter shall operate when the pumps runs, operate at the panel voltage, be mounted on the panel face and have a face diameter of 51 mm or larger
- c) The unit shall water tight and dust tight and mounted in a manner not to reduce the NEMA rating of the panel on which it is installed.
- d) The Trim of the unit shall be constructed of corrosion resistant materials

8. Cycle Counters

- a) Cycle counter will be provided on all pump circuits to indicate the number of times the pump has operated.
- b) The counter shall be panel mounted, operate on the panel voltage and be resettable from the panel face and have a face diameter of 51 mm or larger
- c) The unit shall water tight and dust tight and mounted in a manner not to reduce the NEMA rating of the panel on which it is installed.
- d) The Trim of the unit shall be constructed of corrosion resistant materials

9. Control Relays and Timers

- a) Control relays and timers shall be used as required for control functions.
- b) Relays shall use standard plug-in bases and have an indicator to show operation status.
- c) Timers shall be adjustable through the use of switches or knobs. Timers adjustable through the use of solder on resistors are not acceptable.
- d) Current relays shall be used to verify pump operation and signal pump run to pump station monitor.
- e) All relays shall be identified with a label in the control panel to allow permanent identification Tapes or ink markers are generally unacceptable.

10. Laminate Identification Plates

- a) Identification plates shall be laminated plastic with a brushed" non-glare" finish suitable for routing letters in the surface to create letters on the surface.
- b) A white surface with black routed letters shall be standard; however, other color combinations will be considered.
- c) The plastic laminate shall have a minimum thickness of 3 mm (1/8") and be suitable

for exterior exposure.

- d) The laminate shall be mounted to the surface with adhesive that is suitable for exterior conditions.
- e) A sign shall be installed on the overall cabinet to indicate the 911 address and facility name. The sign shall be on a reflective background with contrasting reflective letters. The letters for the Street No. shall be 4" high and The Facility Name in at least 3" high. The sign shall be bolted to the cabinet.
- f) A face panel layout and name plate schedule shall be submitted with the shop drawings for the control panel.

11. Intrinsically Safe Barrier

- a) A Relay barrier device shall be provided for all sensors mounted in the wetwell. This includes float switches and pump moisture and over heat sensors.
- b) A 24 V Power supply shall be optional to operate the barriers.

12. Power Supply – A low voltage power supply shall be provided if necessary to operate equipment such as Intrinsically Safe Barrier or communication devices.

C.

2.05 Cellular Pump Station Monitor

- A. The pump Station Monitor shall communicate wirelessly to website. The website will be operated by the manufacturer of the Monitor. The website will allow the user to customize the alarm notification process. The alarm condition will be communicated to the website over a cellular carrier data system.
- B. Acceptable Manufacturers. The unit will be manufactured by Mission Communications System. No substitutions are allowed to be consistent with equipment at other Village sites.

C. Functional Characteristics.

- 1. The unit will have a minimum of 8 digital input to monitor dry contacts. Analog inputs are optional.
- 2. The unit shall have LED indicators to indicate the following operational issues: power on/off; RTU Armed or Disarmed; Battery charge State; Transmitting state, continuous signal strength indicator.
- 3. The unit shall have LED indicators for the following diagnostic purpose: Input state for each digital input; primary power input present, output relay state (optional), Radio Status, Account Status, Alarm Status; Violation Status, Suspended Status; Test button Status.
- 4. Serial Port Interface shall be provided for direct communication with and set up of the Monitor.
- 5. Power supply shall be one of 12, 24 or 120 V. It is preferred to have the power supply

integral to the communications unit to allow direct connection to 120 Line volts.

6. The unit shall be capable of operating in the temperature and humidity conditions typically found in an exterior installation.
7. The unit shall be provided with a remote mounted cellular antenna which will be mounted on the side of the Control cabinet.

D. Operation Description

1. User configuration

- a) Local configuration shall be able to be accomplished with the serial port connection.
- b) The unit shall be configurable through the manufacturer's website.

2. Alarm operation

- a) The user shall have a Test Call button to test phone call configurations.
- b) A local alarm acknowledgement and suspension shall be provided to eliminate the need to use the website.
- c) Alarm conditions and return to normal shall be reported to the web site.
- d) The user may access the website to determine the current alarm status and the history of all alarms.

3. Local Alarm/Report Generation:

- a) Runtime for each pump, both daily and accumulative;
- b) Runtime ratio between pumps;
- c) Number of starts for each pump;
- d) Discharge Flow Rate for Each Pump;
- e) Influent Flow rate and totalized flow(calculated);
- f) Hours with two pumps running;
- g) Hours to maintenance based on run times.
- h) Pump Performance alarm – The Unit will provide a notification alarm if the discharge rate of any pump is reduced for a sustained period of time.

E. Website Functions

1. The website shall provide for secure access to the data collected. The website shall have a backup and emergency operations plans in place. The site shall be physically secure to prevent access. None of the user's data will be sold or provided to any third parties.

2. The end users will control the access to the data through an administrator/user account system.

2.06 Spare Parts

- A. Electrical.
 - a) Ten of each size of fuses, indicator lamps and other disposable items.
 - b) One of each size of relay (including the intrinsically safe relays, timers, etc).
 - c) One float.
 - d) One bulb for the cabinet light.
- B. Final Wiring Diagrams: Copies of the as-built wiring diagrams will be laminated and mounted in the overall cabinet.

PART 3 - Execution

3.01 Installation

- A. The contractor shall be responsible for providing all equipment, personnel and supplies needed to install the panel as indicated on the plans, making all electrical connections to remote equipment supplied by the manufacturer or contractor.
- B. The contractor shall be responsible for providing all miscellaneous supplies for mounting control system.
- C. All electrical work must be performed by a Putnam County Licensed Electrician.

3.02 System Start-up

- A. The contractor shall provide for an authorized representative at the time of start up in order to inspect, start and adjust the equipment. An inspection report shall be provided to indicate that there are no conditions that would void warranty of any of the equipment provided.
- B. The pump station monitor shall have an account activated and the first years service paid for. The operator will be trained in the use of the monitor and alarm conditions will be tested to insure proper operations.
- C. The authorized representatives shall start-up each system in the presence of the engineer to insure that the operation is as intended.

END OF SECTION